



E-Learning, DC drives

**DCS800**

**Hardware D5 – D7, part 2**

**G569e\_a\_b Part 2**

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HARDWARE\_D5-D7\_02R0301

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Welcome to the Hardware D5 to D7 training module part 2 for the DCS800, ABB DC Drives.

If you need help navigating this module, please click the Help button in the top right-hand corner. To view the presenter notes as text, please click the Notes button in the bottom right corner.

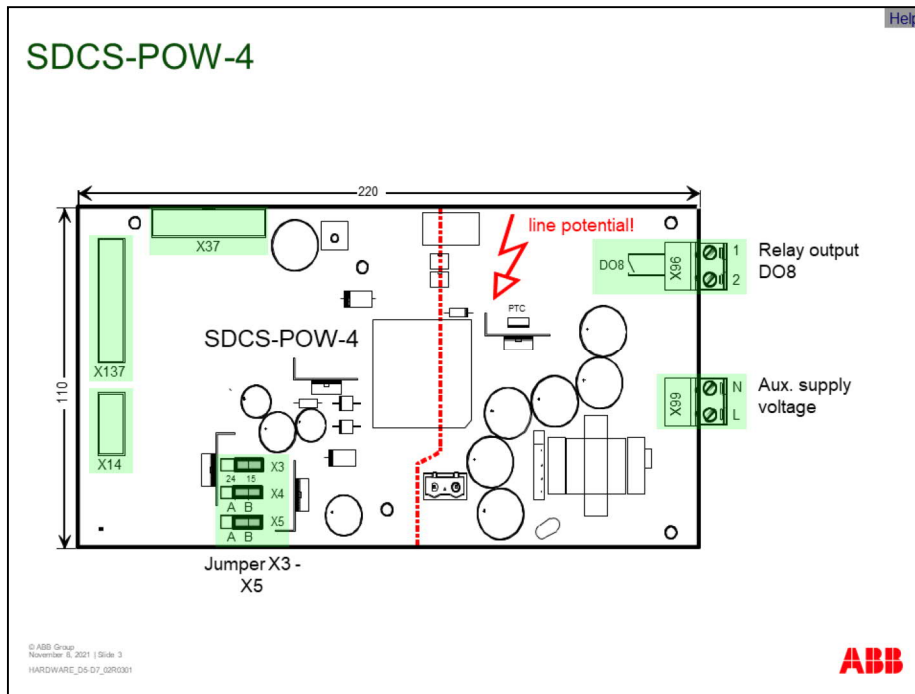
# Objectives

## **This training module covers:**

- Function of POW-4 board
- Internal field exciter FEX-4 25
- Function of DSL board
- Controller board CON-4
- Line reactors
- Dedicated transformers

This training module covers:

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The SDCS-POW-4 is designed for module sizes D5 to D7. It is mounted on the electronic tray. The SDCS-POW-4 generates all necessary auxiliary voltages for the whole drive and the connected options. The power supply on the SDCS-POW-4 is not a universal power supply. The power supply automatically adjusts itself to an auxiliary supply voltage of either 230 VAC or to 115 VAC.

The 230 VAC or 115 VAC auxiliary supply voltage is connected to connector X99. The input features a hardware filter and a voltage limitation.

To control the main circuit breaker a relay is needed. To save an additional relay in the cabinet the DCS800 provides a normally open relay contact integrated on the SDCS-POW-4. This relay output is controlled by digital output 8 and connected to connector X96. The function or signal definition of digital output 8 is done in the firmware by means of parameters.

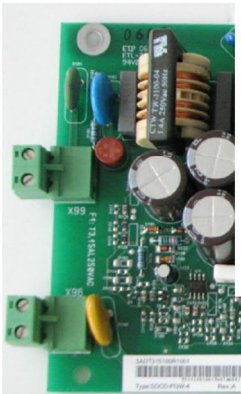
Connectors X37 and X137 are connected in parallel and used to connect the SDCS-POW-4 to the control board SDCS-CON-4 via flat cable.

Connector X14 is used for connection to hard parallel converters.

The SDCS-POW-4 also provides different supply voltages for attached encoders.

# SDCS-POW-4

Help

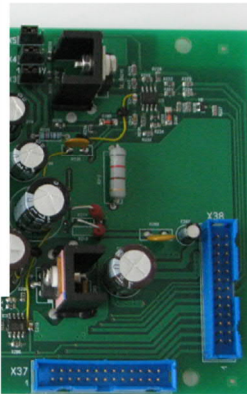


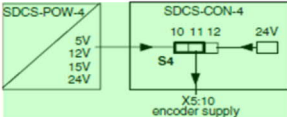
**Jumper coding**

**X3** Encoder supply selection

	X3	X4	X5	Sense function
5 V *	15V 24V	B A	B A	yes
12 V	15V 24V	B A	B A	yes
15 V	15V 24V	B A	B A	no
24 V	15V 24V	B A	B A	no

\* default value



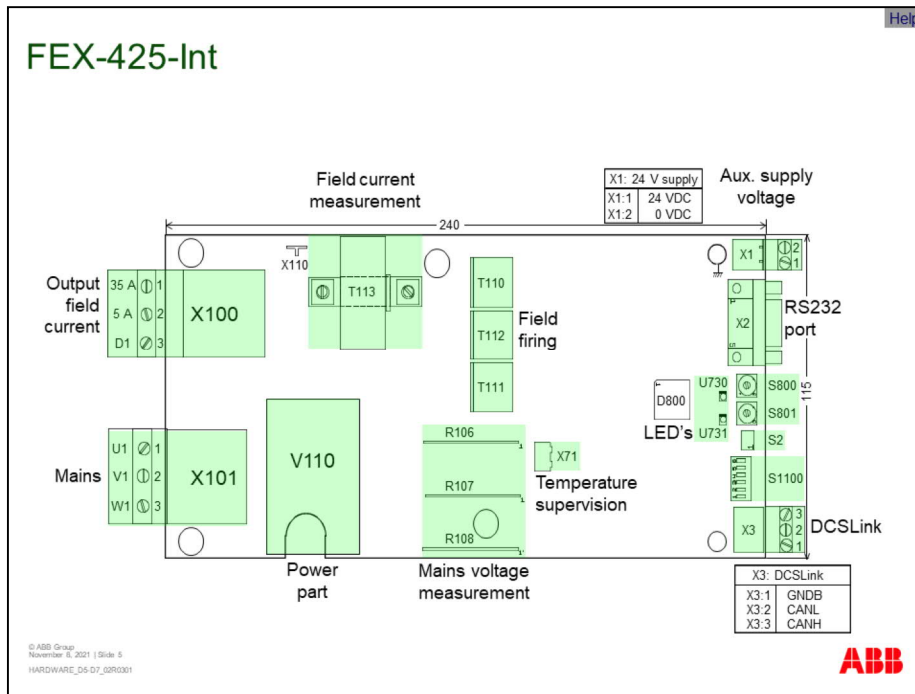


**ABB**

With jumpers X3 to X5 it is possible to set the supply voltage to either 5 V, 12 V, 15 V or 24 V.

To make the different supply voltages available for the encoder connected at the SDCS-CON-4 set jumper S4 to 10 - 11.

Photo of the SDCS-POW-4



The FEX-425-Int is based on a half controlled three-phase bridge with a free-wheeling diode as power part and the FEX-4 as controller board. The field exciter is equipped with its own snubber circuit, supply voltage synchronization and current control. The current measurement is automatically scaled according to the rated field current. The internal field exciter FEX-425-Int is only used for converters of size D5. If selected by its plus code +S164 the internal field exciter FEX-425-Int is located on the left-hand side of the electronic tray under the plastic cover. It can supply motor field currents up to 25 ADC. The necessary fuses for the field are supplied as well. The field exciters line reactor is located externally.

The field exciter is fully controlled and monitored by the armature converter via the DCSLink.

The mains cables are connected at connector X101. The supply voltage is variable between 100 VAC and 500 VAC. The field exciter is prepared to operate with either all three phases or with only one single phase connected. Single phase operation is using terminals U1 and W1. For single phase operation an autotransformer for voltage adaptation is recommended.

The high resistance voltage measurement of the mains voltage is in the middle of the FEX-425-Int.

The cables for the field supply are connected at connector X100. For field currents between 5 A up to 25 A use terminal 1 and 3. For field currents between 0.3 A up to 5 A use terminal 2 and 3.

A direct field current measurement is done via transformer T113. The measurement of the field current is automatically scaled and selected by the firmware.

The firing pulse transformers T110 to T112 for the power part are in the middle of the FEX-425-Int.

The power block itself is soldered at the bottom of the FEX-4. It contains the half controlled three-phase bridge with a free-wheeling diode.

The PTC for the temperature supervision of the field exciter is connected at connector X71.

The auxiliary supply voltage is connected to connector X1. The input voltage of 24 VDC is connected at terminal 1 and ground is connected at terminal 2. The maximum needed supply current is smaller than 200 mA and the field exciter can be supplied via the SDCS-DSL-4 board.

For diagnosis purposes two LED's the green U730 and the yellow U731 are used. All codes are listed in the DCS800 Hardware Manual.

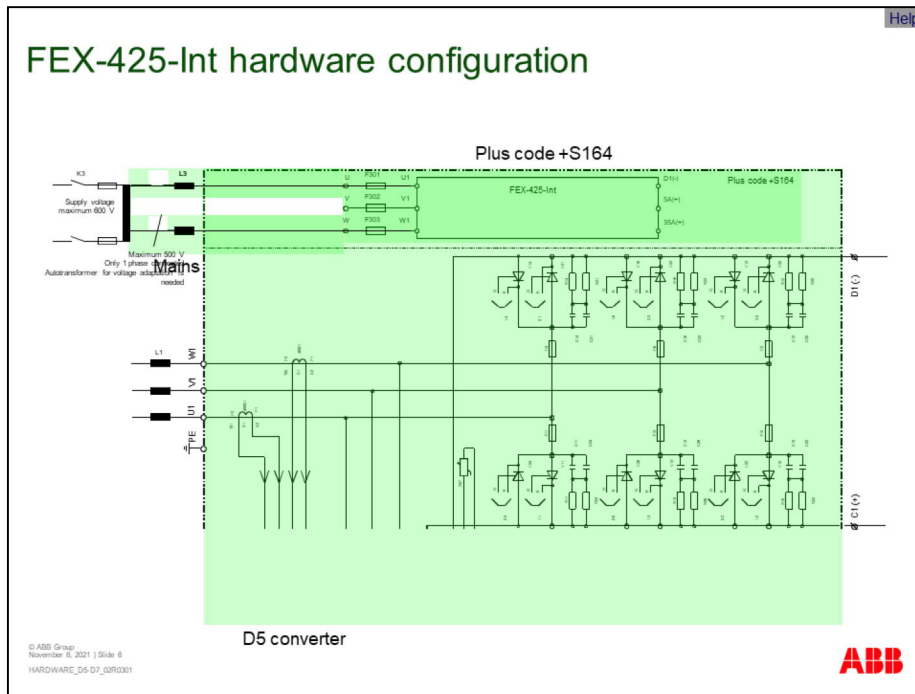
The FEX-425-Int is fully controlled and monitored by the armature converter via the DCSLink. The DCSLink is a serial communication based on the CANbus protocol and uses a twisted pair cable with shield. The DCSLink cable is connected to connector X3. The shield of the cable is connected to terminal 1. CANbus low is connected to terminal 2 and CANbus high is connected to terminal 3.

In the DCSLink network each device needs a node number. The node number for the FEX-425-Int is set by means of rotary switches S800 and S801.

The bus termination, ground termination and the communication speed of the DCSLink is set by means of switch S1100.

The RS232-port is used for downloading the field exciter firmware, in case jumper S2 is set to 1-2. The normal setting for

jumper S2 is 3-4.



The FEX-425-Int is built in a DCS800 converter module size D5.

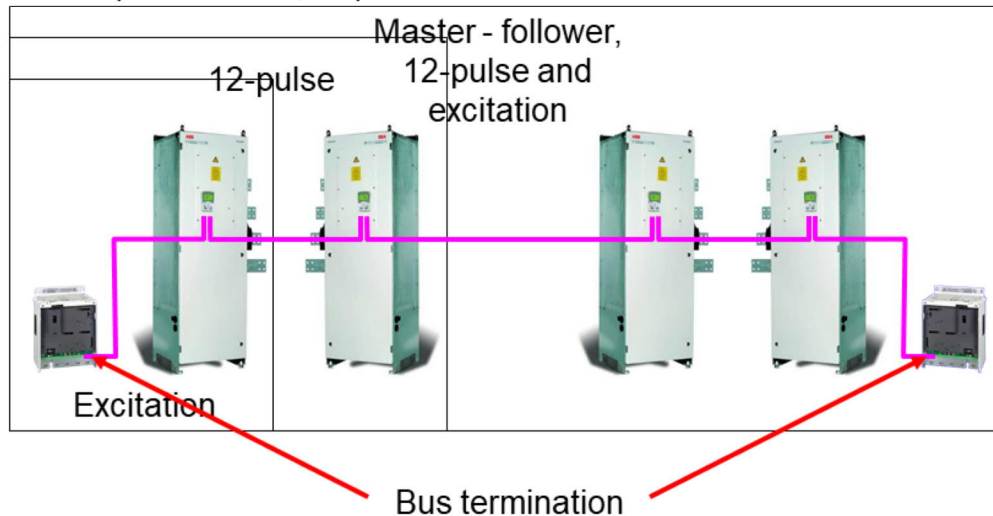
The FEX-425-Int and the fuses F301 to F303 will be mounted in the D5 converter by the factory when using plus code S164.

The line reactor for the field exciter is located externally and thus has to be ordered separately. The maximum supply voltage is 500 VAC. All 3 phases are connected, thus no autotransformer for voltage adaptation is needed.

In case only one phase is connected an autotransformer for voltage adaptation is needed. The maximum supply voltage with autotransformer is 600 VAC. Also, the line reactor for the field exciter is located externally and thus has to be ordered separately.

## DCSLink

- SDCS-DSL-4: One hardware for several configurations at the same time
- Example: excitation, 12-pulse and master - follower



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The DCSLink is a multi purpose communication link for the DCS800 based on the SDCS-DSL-4 board and a simple screened twisted pair cable.

One type of connection is used for communication to field exciters, for master-follower communication, drive-to-drive communication and 12-pulse communication. This slide gives an overview of the different communication types.

The DCSLink is used for an armature converter controlling an external field exciter.

To get a 12-pulse system a second armature converter is added and simply connected with the first armature converter via DCSLink.

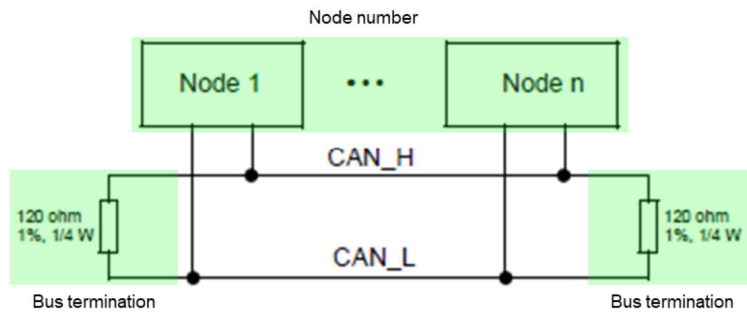
Now another 12-pulse system is added and connected via DCSLink, and a master follower operation is possible.

Since the DCSLink is a bus system using twisted pair cables a bus termination is mandatory at its two physical ends.

This example shows the capability of the DCSLink. With one type of hardware and a simple cable connection 3 different kinds of communications can be done at once.



## DCSLink wiring

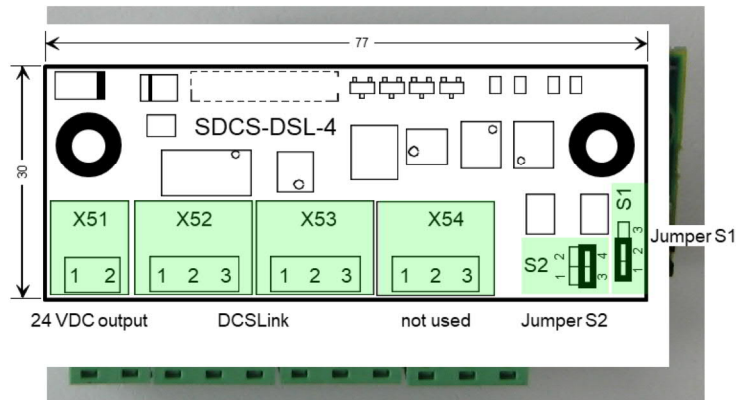


This drawing shows a more detailed picture of the wiring. The twisted pair cable is usually shielded and contains CANbus low and CANbus high signals.

The bus termination resistance of 120 Ohm is typical for a twisted pair cable and is located at both ends of the cable. The bus termination can be activated by jumper S1 on the SDCS-DSL-4 board. The preferred cable type is a DeviceNet cable.

Every bus node requires its own unique node number. Switched off nodes can remain in the bus and do not disturb the serial communication.

## SDCS-DSL-4



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The SDCS-DSL-4 plugs onto the SDCS-CON-4 and provides the DCSLink communication link for the DCS800.

Connectors X52 and X53 provide the DCSLink. Both connectors provide the same function, since they are connected in parallel on the SDCS-DSL-4. Terminal one is used to connect the shield of the cable if present, terminal 2 is used for the CANbus low signal and terminal 3 is used for the CANbus high signal.

Connector X51 provides 24 VDC with maximum current of 200 mA. This power supply can be used to supply the FEX-425-Int and the external field exciters DCF803-0016 and DCF803-0035.

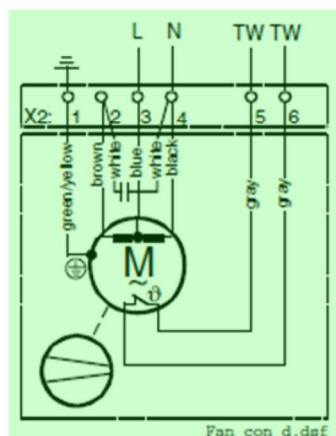
To activate the bus termination set jumper S1 to 1 - 2. Position 2 - 3 is the default setting and the bus termination is disabled.

To activate the ground termination use jumper S2. For ground termination via a R-C network set jumper S2 to 2 - 4. For a hard ground termination set jumper S2 to 1 - 3. 3 - 4 is the default setting and the ground termination is disabled.

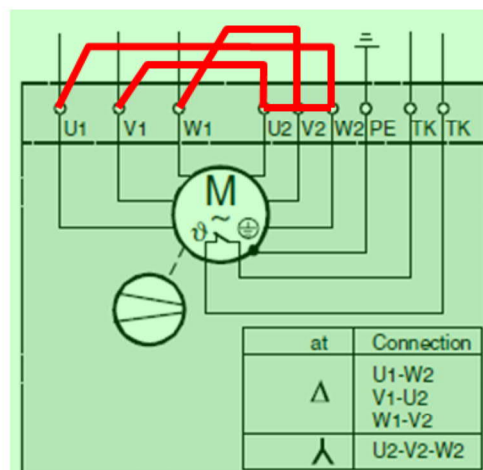
Connector X54 is currently not used and has no functionality.

Photo of the SDCS-DSL-4.

## Fan connection D5 - D7



Configuration 4  
D5  
900 - 2000 A



Configuration 5  
D6 and D7  
1900 - 5200 A

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The converter fans are used to force cool air through the heat sink of the drive and thus the modules are cooled. The connector for all cooling fans of converters size D5 to D7 is located on the cooling fan itself.

For converters of size D5 with nominal currents from 900 A to 2000 A the fan is located under the housing. The fan has a nominal incoming voltage of 230 VAC.

For converters of size D6 with nominal currents from 1900 A to 3000 A two types of fans are used depending on the incoming voltage. The fans either have a nominal incoming voltage of 380 VAC to 500 VAC or 525 VAC to 690 VAC.

For converters of size D7 with nominal currents from 2050 A to 5200 A only one type of fan is used. The fan has a nominal incoming voltage from 400 VAC to 690 VAC.

The shown connection diagram is the same for all fans of converters size D6 and D7.

To archive the wide incoming voltage range for the fans it is possible to connect the fans either in delta or in star connection. For higher incoming voltages use the star connection.

To connect the fans in delta connection following terminals have to be interconnected. Connect:

- U1 with W2,
- V1 with U2 and
- W1 with V2 .

To connect the fans in star connection following terminals have to be interconnected. Connect:

- U2 with V2 and W2.

## Line reactors D5

DCS Type		Line choke 1 %	Design Fig.	Line choke 4 %	Design Fig.
2-Q Converter	4-Q Converter				
DCS800-S01-0900-06/07	DCS800-S02-0900-06/07	ND13	3	on request	-
DCS800-S01-1200-04/05	DCS800-S02-1200-04/05	ND14	3	on request	-
DCS800-S01-1500-04/05/06/07	DCS800-S02-1500-04/05/06/07	ND15	3	on request	-
DCS800-S01-2000-04/05	DCS800-S02-2000-04/05	ND16	3	on request	-
DCS800-S01-2000-06/07		ND16 *	3	on request	-

\* with forced cooling



Fig. 3

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This table shows all line reactors used for the module size D5.

Standard line reactors with an uk of 1 % are available for all sizes D5 and incoming voltages from 400 VAC to 690 VAC. They are the minimum requirement in industrial environment. They feature a low inductive voltage drop and reduce deep commutation notches.

Line reactors ND13 to ND16 are equipped with busbars. See design figure 3. Don't use the line reactor terminals as cable or busbar support. The line reactor ND16 used for the largest D5 unit needs small forced cooling. The air flow should be about one meter per second.

Line reactors for modules size D5 with an uk of 4 % are only available on request.

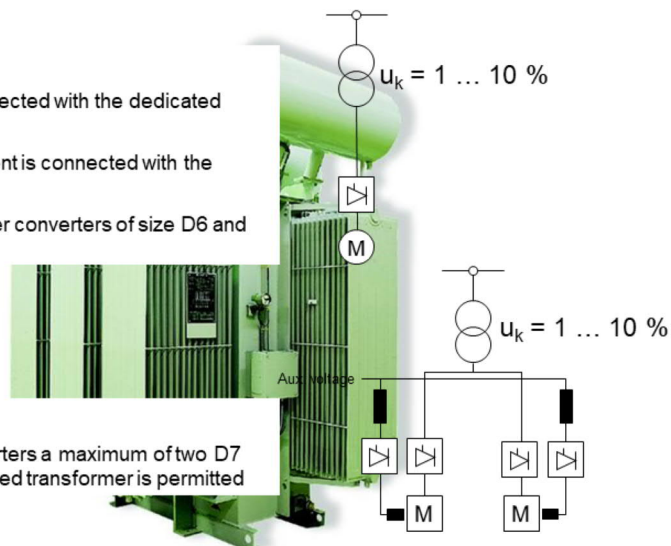
## Dedicated transformers for D6 and D7

### Standard

- Only one drive is connected with the dedicated transformer
- No additional equipment is connected with the dedicated transformer
- Typically for high power converters of size D6 and D7

### Exception

- When using D7 converters a maximum of two D7 converters per dedicated transformer is permitted



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Dedicated transformers are especially designed to supply high power converters and located before the drive. They are usually used for converters of size D6 and D7. Line reactors for these high-power drives become too large and it is cheaper to use dedicated transformers.

As a standard each high-power drive is connected to its own dedicated transformer. It is not permitted to connect any other equipment or a second drive on the secondary side of the dedicated transformer, since the commutation notches of high-power drives are usually so severe, that they disturb the proper function of the equipment or in some cases even destroy it.

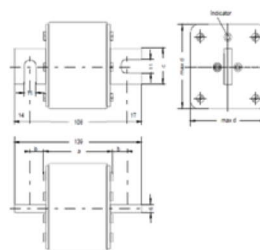
The relative short-circuit voltage -  $u_k$  - of the dedicated transformer should be between 1 % to 10 %. For example, for a transformer with an overload of 200 % a maximum of 5 %  $u_k$  is recommended.

This configuration is typical for the supply of high-power converters sizes D6 and D7.

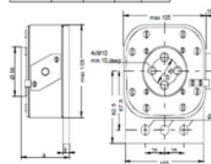
As usual there is no rule without exception. High power converters of size D7 are designed in a way, that they can work together with another D7 converter behind one dedicated transformer.

## Semiconductor fuses D5 - D7

Converter type	Model	Fuse F1
<b>400 V / 500 V</b>		
DCS800-S0x-1200-04/05	D5	800A 660V UR
DCS800-S0x-1500-04/05	D5	1250A 660V UR
DCS800-S0x-2000-04/05	D5	1600A 660V UR
DCS800-S0x-2050-51	D6	1500A 660V UR
DCS800-S0x-2500-04/05	D6	900A 660V UR ①
DCS800-S01-3000-04/05	D6	1250A 660V UR ①
DCS800-S02-3000-04/05	D6	1250A 660V UR ①
DCS800-S0x-3300-04/05	D7	2500A 660V UR
DCS800-S0x-4000-04/05	D7	3000A 660V UR
DCS800-S0x-5200-04/05	D7	3500A 660V UR
<b>600 V / 690 V</b>		
DCS800-S0x-0900-06/07	D5	630A 1250V UR
DCS800-S0x-1500-06/07	D5	1100A 1250V UR
DCS800-S01-2000-06/07	D5	1400A 1100V UR
DCS800-S0x-2050-06/07	D6	700A 1250V UR ①
DCS800-S0x-2500-06/07	D6	1000A 1250V UR ①
DCS800-S01-3000-06/07	D6	1100A 1250V UR ①
DCS800-S02-3000-06/07	D6	1100A 1250V UR ①
DCS800-S0x-3300-06/07	D7	2500A 1000V UR
DCS800-S0x-4000-06/07	D7	3000A 1000V UR
DCS800-S0x-4800-06/07	D7	3000A 1000V UR
<b>790 V</b>		
DCS800-S0x-1900-08	D6	700A 1250V UR ①
DCS800-S0x-2050-08	D6	700A 1250V UR ①
DCS800-S0x-2500-08	D6	1000A 1250V UR ①
DCS800-S01-3000-08	D6	1100A 1250V UR ①
DCS800-S02-3000-08	D6	1100A 1250V UR ①
DCS800-S0x-3300-08	D7	2500A 1000V UR
DCS800-S0x-4000-08	D7	3000A 1000V UR
DCS800-S0x-4800-08	D7	3000A 1000V UR
<b>1000 V</b>		
DCS800-S0x-2050-10	D7	1800A 1250V UR
DCS800-S0x-2600-10	D7	1800A 1250V UR
DCS800-S0x-3300-10	D7	2500A 1250V UR
DCS800-S0x-4000-10	D7	2500A 1250V UR



Size	a	b	c	d
5	50	29	30	76
6	80	14	30	76



Size	A
7	62
8	90
9	105
10	120

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**ABB**

This table shows all semiconductor fuses used for the modules sizes D5 to D7.  
For different module sizes and incoming voltage different semiconductor fuses are needed.  
Depending on the converter type different kind of semiconductor fuses are used.

# Summary

## Key points of this module are:

- Function of POW-4 board
- Internal field exciter FEX-4 25
- Function of DSL board
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## Additional information

- DCS800 Hardware Manual (3ADW000192)
- DCS800 Technical Catalogue (3ADW000194)



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